

1 1. A polyethylene composition comprising a low-molecular-weight (LMW)
2 ethylene homopolymer component and a homogeneous, high-molecular-weight (HMW)
3 ethylene interpolymer component, wherein the LMW component is characterized as having
4 a molecular weight distribution, MWD^L , of less than about 8 and a weight average
5 molecular weight, M_w^L , and wherein the polyethylene composition is characterized as
6 having a bimodal molecular weight distribution, and a ductile-brittle transition temperature,
7 T_{db} , of less than -20°C .

1 2. The polyethylene composition of claim 1, wherein the LMW component has
2 a density of greater than about 0.965 g/cm^3 .

1 3. The polyethylene composition of claim 1, wherein the LMW component has
2 an I_2 value ranging from about 30 to about 1000 g/10 minutes as determined in accordance
3 with ASTM D-1238 (Condition 2.16 kg/190°C).

1 4. The polyethylene composition of claim 1, wherein the HMW component has
2 a density ranging from about 0.905 to about 0.955 g/cm^3 .

1 5. The polyethylene composition of claim 1, wherein the HMW component has
2 an $I_{21.6}$ value ranging from about 0.1 to about 1.0 as determined in accordance with ASTM
3 D-1238 (Condition 21.6kg/190°C).

1 6. The polyethylene composition of claim 1, wherein the HMW component has
2 an $I_{21.6}$ value ranging from about 0.1 to about 0.6 as determined in accordance with ASTM
3 D-1238 (Condition 21.6kg/190°C).

1 7. The polyethylene composition of claim 1, wherein the HMW component has
2 an $I_{21.6}$ value ranging from greater than 0.6 to about 1.0 as determined in accordance with
3 ASTM D-1238 (Condition 21.6 kg/190°C).

1 8. The composition of claim 1, wherein the HMW is characterized by a
2 unimodal molecular weight distribution, MWD^H of about 8 or less and a weight average
3 molecular weight M_w^H .

1 9. The composition of claim 8, wherein M_w^H/M_w^L is about 1.3 or higher.

- 1 10. The composition of claim 1, wherein MWD^L is about 5 or less.
- 1 11. The composition of claim 1, wherein MWD^L is about 3 or less.
- 1 12. The composition of claim 1, wherein MWD^L is about 2.
- 1 13. The composition of claim 8, wherein MWD^H is about 5 or less.
- 1 14. The composition of claim 8, wherein MWD^H is about 3 or less.
- 1 15. The composition of claim 8, wherein MWD^H is about 2.
- 1 16. The polyethylene composition of claim 1, wherein the polyethylene
2 composition is characterized as a molecular weight distribution (MWD) as defined by the
3 ratio of M_w/M_n of about 30 or less, and the HMW component is characterized as having a
4 substantially uniform comonomer distribution or a reverse comonomer distribution.
- 1 17. The composition of claim 16, wherein the HMW component has a
2 substantially uniform comonomer distribution characterized by a SCBDI of greater than 70
3 percent.
- 1 18. The composition of claim 16, wherein the HMW component has a reverse
2 comonomer distribution characterized as the molar comonomer content of interpolymer
3 fractions having a M_w greater than or equal to 300,000 g/mole being at least 25 percent
4 higher than the molar comonomer content of interpolymer fractions having a M_w of less
5 than or equal to 100,000 g/mole.
- 1 19. The composition of claim 1, wherein the T_{db} is less than about -25°C .
- 1 20. The composition of claim 1, wherein the T_{db} is less than about -30°C .
- 1 21. The composition of claim 1, wherein the T_{db} is less than about -40°C .
- 1 22. The composition of claim 1, wherein the T_{db} is less than about -50°C .
- 1 23. The composition of claim 1, wherein the molecular weight distribution,
2 M_w/M_n , of the composition is less than or equal to 20, as determined using gel permeation
3 chromatography.

1 24. The composition of claim 1, wherein the composition is characterized as
2 having an $I_{21.6}/I_5$ ratio of less than or equal to 22.5, as determined in accordance with ASTM
3 D-1238 (Condition 21.6 kg/190°C and Condition 5 kg/190°C).

1 25. The composition of claim 1, wherein the composition is characterized as
2 having an $I_{21.6}$ ranging from about 3 to less than about 50 g/10 min., as determined in
3 accordance with ASTM D-1238 (Condition 21.6 kg/190°C).

1 26. The composition of claim 1, wherein the composition is characterized as
2 having an $I_{21.6}$ ranging from about 3 to about 12 g/10 min., as determined in accordance
3 with ASTM D-1238 (Condition 21.6 kg/190°C).

1 27. The composition of claim 1, wherein the composition is characterized as
2 having an $I_{21.6}$ ranging from about 12 to less than about 50 g/10 min., as determined in
3 accordance with ASTM D-1238 (Condition 21.6 kg/190°C).

1 28. The composition of claim 1, wherein the composition is characterized as
2 having an I_5 ranging from about 0.1 to about 2 g/10 min., as determined in accordance with
3 ASTM D-1238 (Condition 5 kg/190°C).

1 29. The composition of claim 1, wherein the composition is characterized as
2 having a density greater than about 0.938 g/cm³.

1 30. The composition of claim 1, wherein the composition is characterized as
2 having a M_{v1}/M_{v2} ratio of less than or equal to 0.6, where M_{v1} is the viscosity average
3 molecular weight of the LMW high density component and M_{v2} is the viscosity average
4 molecular weight of the HMW interpolymer component, as determined using ATREF-DV
5 analysis.

1 31. The composition of claim 1, wherein the composition is manufactured using
2 a multiple reactor slurry polymerization system.

1 32. The composition of claim 31, wherein the polymerization system comprises
2 two autoclave reactors.

1 33. The composition of claim 32, wherein the two reactors are configured in
2 series.

1 34. The composition of claim 33, wherein a supported metallocene catalyst
2 system is used.

1 35. The composition of claim 34, wherein catalyst is separately injected into
2 each reactor.

1 36. The composition of claim 34, wherein the catalyst system is injected into the
2 first reactor and no catalyst is injected into the second reactor such that polymerization in
3 the second reactor is accomplished from carry-over catalyst or live polymer or both from
4 the first reactor.

1 37. The composition of claim 34, wherein the metallocene catalyst is a
2 constrained geometry catalyst.

1 38. The composition of claim 35, wherein the catalyst is a constrained geometry
2 catalyst system.

1 39. The composition of claim 34, wherein the same catalyst is separately injected
2 into each reactor.

1 40. The composition of claim 39, wherein the catalyst is a constrained geometry
2 catalyst system.

1 41. The composition of claim 34, wherein the catalyst system comprises an
2 activator which has been bonded or fixed to the support prior to the addition of the
3 metallocene catalyst.

1 42. The composition of claim 41, wherein the activator is a boron-containing
2 compound.

1 43. The composition of claim 41, wherein the activator is an alumoxane.

1 44. The composition of claim 1, wherein the HMW component is characterized
2 as having a reverse comonomer distribution.

1 45. The composition of claim 44, wherein the reverse comonomer distribution is
2 characterized by a comonomer distribution gradient in the range from about 0.0001 to about
3 0.1.

1 46. The composition of claim 44, wherein the reverse comonomer distribution is
2 characterized by a comonomer distribution gradient in the range from about 0.0005 to about
3 0.05.

1 47. The composition of claim 44, wherein the reverse comonomer distribution is
2 characterized by a comonomer distribution gradient in the range from about 0.001 to about
3 0.02.

1 48. The composition of claim 1, wherein the M_w/M_n of the composition is about
2 25 or less.

1 49. The composition of claim 1, wherein the M_w/M_n of the composition is
2 between about 5 and about 20.

1 50. An article of manufacture made from the composition claim 1.

1 51. The article of claim 50, wherein the article is a water pipe.

1 52. The article of claim 50, wherein the article is a gas pipe.

1 53. A method of increasing the service life of a pipe comprising using the
2 polyethylene composition claim 1 to form the pipe.

1 54. A polyethylene composition comprising a low-molecular-weight (LMW)
2 ethylene homopolymer component and a high-molecular-weight (HMW) ethylene
3 interpolymer component, wherein the polyethylene composition is characterized as having a
4 bimodal molecular weight distribution, the molecular weight distribution as defined by the
5 ratio of M_w/M_n is about 30 or less, and the HMW component is characterized as having a
6 reverse comonomer distribution.